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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/715,935	11/17/00	BI X	2950.16US02

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EXAMINER	
FULLER,E	
ART UNIT	**PAPER NUMBER**
1762	5

DATE MAILED: 10/22/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No.	Applicant(s)	
	09/715,935	BI ET AL.	
	Examiner	Art Unit	
	Eric B Fuller	1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 17 November 2000 .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-42 is/are pending in the application.

4a) Of the above claim(s) 1-17 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 18-42 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) 1-42 are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 17 November 2000 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-17, drawn to an apparatus, classified in class 118, subclass 620.

II. Claims 18-42, drawn to a method, classified in class 427, subclass 457.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus may be used for an etching or polishing process.

Because these inventions are distinct for the reasons given above and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

During a telephone conversation with Peter Dardi on September 26, 2001 a provisional election was made with traverse to prosecute the invention of II, claims 18-42. Affirmation of this election must be made by applicant in replying to this Office action. Claims 1-17 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a petition under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 102

> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

Claims 18 and 29 are rejected under 35 U.S.C. 102(e) as being anticipated by Akedo et al.

Akedo et al. teaches a process of accelerating ultrafine particles within a vacuum chamber and colliding them with a substrate in order to apply a thin film of the particles to the substrate. Prior to the collision, a step of radiation is used to activate the surfaces of the particles (abstract). This activation process is a type of reaction. The substrate is then moved relative to the product stream (column 3, lines 10-13) in order to complete the coating process. Column 4, lines 29-32, teach that electrostatic acceleration may be used to generate a larger particle stream surface area and in column 2, line 67, the product stream is accelerated by an electric field gradient.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 18-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akedo et al. in view of Bi et al.

Akedo et al. teaches a film forming apparatus that directs a particle stream, which is made up of nanoparticles, to a substrate and moves the substrate relative to the particle stream in order to coat the substrate (column 3, line 10-12). The input of this apparatus is a continuous stream of particles with a size ranging between 10 nanometers to 5 microns (column 2, lines 41-60). Akedo et al. fails to teach that this continuous stream of nanoparticles comes from the applicants claimed particle producing apparatus. Bi et al. teaches an apparatus that reacts a reactant stream by directing a focused radiation beam at the reactant stream to produce a product stream comprising particles downstream from the radiation beam, wherein the reaction is driven by energy from the radiation beam (summary). The product stream of this apparatus is a continuous stream of nanoparticles. The benefit over the prior art in using this method in order to produce nanosized particles is the efficient use of resources at high production capacity without sacrificing particle quality (column 2, lines 16-24). Therefore, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to replace the aerosolizing chamber of the Akedo et al. apparatus (reference 21, figure 1) with the apparatus shown taught by Bi et al. in figures 2, 3, and 4 in order to reap the benefits of the efficient use of resources at high production capacity without sacrificing particle quality. The method that results from this

combined apparatus meets all the limitations set forth in applicant's claims 18-29, as will be further discussed.

Bi et al. further teaches that the source of radiation can include a laser (column 1, line 51), as pertinent to claims 19 and 20. Bi et al. also teaches that the reactant stream is elongated in a direction along the propagation of the radiation beam and a line of light propagates to intersect this elongated stream (column 1, line 40-45; column 4, lines 53-60), as pertinent to claims 22, 24, and 26.

Akedo et al. teaches using an electric field gradient to accelerate the product particles towards the substrate (column 2, line 67), as pertinent to claim 29. Akedo et al. further teaches moving the substrate relative to the particle-depositing stream in order to coat the substrate (column 3, lines 10-12). To move the substrate by means of a movable stage, as in a conveyor belt and pertaining to claims 23 and 24, or to move the entire apparatus over a stationary substrate, as the term "relative to" (line 10) indicates, or to pass the particle stream through on conduit that can sweep over the substrate, as in a hose and nozzle system and pertaining to claim 28, are obvious variants of each other and it would have been obvious at the time the invention was made to a person having ordinary skill in the art to perform either of these operations in order to achieve the desired effect of moving the substrate relative to the product stream. When moving the entire apparatus over a stationary substrate, the reactor inlet moves relative to the substrate and the substrate is swept with the particle stream, meeting the limitations set forth in claim 27. Additionally, it also would have been obvious that when one substrate is completely coated, to remove it from the particle

stream and to place another, non-coated, substrate in the path of the particle stream, as pertinent to claim 25. Lastly, the examiner takes official notice that pumping is a commonly used and widely known method of transporting gas streams as pressure gradients result in gases being moved. To pump on the reaction chamber to maintain flow though the reaction chamber would have been an obvious way to maintain reactant flow into the reaction chamber.

Claims 21, 23, 25, 27, and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akedo et al.

Akedo et al., as noted above teaches the limitations set forth in applicant's claim 18. The additional limitations set forth in these depending claims are obvious for the same reasons as given above. These limitations would have been equally as obvious to the Akedo et al. process as they would have been to the combined Akedo et al. and Bi et al. process.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lehman in view of Akedo et al. and Bi et al., and further in view of Kambe et al.

Lehman teaches a process of producing a glass coating that involves applying frit to a cold or heated substrate. If the substrate is cold, a series of heating and cooling steps are performed in order to melt, fuse, and anneal the glass coating (column 6, lines 1-20). However, the frit in this reference is produced from grinding a bulk substance and producing 200-325 mesh sized particles. Bi et al. teaches that nanoparticles exhibit exploitable chemical and mechanical properties that are different from larger sized particles (background), and that the taught apparatus is advantageous to use in order to

produce these nanoparticles due to its efficient use of resources (column 2, lines 17-25). An additional obvious benefit of having the particles be of a smaller size would be the ability to form thinner, or more uniform, films of glass, which is needed for the surfaces of wafers. The Bi et al. and Akedo et al. references can be combined as taught previously in order to produce coatings by nanoparticles, and therefore it would have been obvious at the time the invention was made to a person having ordinary skill in the art to use the method taught by Bi et al. and Akedo et al. in order to produce the frit that is to be used in the Lehman process in order to reap the benefits of a thinner, or more uniform, coating. The Kambe et al. reference is used in order to prove that the combined Bi et al. and Akedo et al. apparatus is capable of producing glass particles. Kambe et al. teaches the similar apparatus as Bi et al. (as they have the same inventive entity), but the apparatus taught by Kambe et al. performs a different process. The nanoparticles produced in the Kambe et al. apparatus is silica oxide (abstract), which can be used for producing glass. It would have been obvious from the Kambe et al. reference that the apparatus taught by Bi et al. would be able to produce silica oxide nanoparticles. Furthermore, it would have been obvious that the combined Akedo et al. and Bi et al. apparatus is able to produce silica oxide coatings as well, as column 5, first paragraph of the Akedo et al. reference teaches that the apparatus taught is capable of producing oxide films as well.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lehman in view of Akedo et al.

It would have been obvious to combine the teachings of Lehman with the teachings of Akedo et al. in order to use smaller particles for the coating material instead of the larger sized frit for the same reasons as combining the Lehman reference to the Bi et al. and Akedo et al. references. The benefits of using smaller particle sizes for the coating material would be the ability to make thinner or more uniform coatings, as noted above.

Claims 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tran et al. in view of Lehman, and further in view of Akedo et al. and Bi et al. in view of Kambe et al.

Tran et al. teaches that in order to produce an optical component, it is required to produce an optical component layer (abstract, summary), which is typically glass. Then photolithography is used to fabricate the optical component (column 3, line 59). Tran et al. fails to give the details of the optical layer. As was taught previously, the Lehman, Akedo et al., Bi et al., and Kambe et al. references can all be combined to teach a method of producing a glass coating that has the advantages of being more uniform and is capable of being thinner. To use this method of forming a glass coating when producing the optical layer taught in the Tran et al. reference would have been obvious at the time the invention was made to a person having ordinary skill in the art in order to reap the benefits of a thinner, more uniform, coatings.

Claims 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tran et al in view of Lehman and Akedo et al.

It would have been obvious to combine the teachings of Tran et al. with the teachings of Akedo et al. and Lehman for the same reasons and benefits given above.

Claims 33-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akedo et al. in view of Bi et al.

It has been established previously that is would have been obvious at the time the invention was made to combine these two references. The way they meet the applicant's claimed limitations will be further discussed.

Bi et al. teaches a process where a reactant stream with a cross section perpendicular to the propagation direction characterized by a major and minor axis, the major axis being at least a factor of ten times greater than the minor axis (as shown in the values given in column 4, lines 52-59) and reacting the reactant stream to form a product stream of particles (summary), as pertinent to claim 33 and 36. The radiation can be in the form of a light beam (column 1, line 51), as pertinent to claim 35. Figure 1 shows a pump that is attached after the collection chamber, wherein filters are in place to collect the particles, that is used to evacuate that chamber and allow the momentum of the product maintain the flow of the particle stream leaving the reaction chamber, as pertaining to claims 37 and 38. As the filter and the substrate both are designed to collect the nanoparticles, it would be obvious to have a coating chamber of the same type in place of, or prior to, the filter chamber.

Akedo et al. teaches the process of applying an electric field to accelerate the particles through an optional nozzle onto the substrate (column 4, line 29-32;column 2, line 66). This meets the limitations set forth in claim 33 and also 37. A process of

evacuating a chamber to produce a flow into the chamber is also described in column 3, line 35, which can be obviously applied to a substrate chamber and meet limitations set forth in claims 37 and 38. Akedo et al. also teaches that the speed of the particles being applied to the substrate can be as high as 300 m/sec (column 3, line 29). It is known in the art that mass flow-rate is dependent upon velocity, cross sectional area, and density and affects the film thickness that will be deposited. Using these high speeds required of the Akedo et al. reference and the densities that are properties of the particles being produced, it is within the skill of one practicing in the art to adjust the cross sectional area such that the a mass flow-rate is produced that is high enough to sufficiently coat the substrate to a desired thickness and at a desired rate, as pertaining to claim 34.

Claims 39-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akedo et al. or Akedo et al. in view of Bi et al.

As noted above, the Akedo et al. reference is used alone to teach a process of depositing particles onto a substrate after the surface of the particles are activated by radiation, or both references are combined to teach a method of depositing nanoparticles that are produced by laser pyrolysis onto a substrate.

Claim 39 adds in the preamble that the substrate has a diameter greater than 5 cm. However, since the function of the apparatus is not dependant on the shape or size of the substrate, it would have been obvious that the substrate could be flat or spherical and the process would still be performed as taught. Claim 39 also adds the limitation that the particle stream is deposited at a rate of 5 grams per hour. This limitation is

within the skill of one practicing in the art for the cause and effect relationship that is taught above.

Akedo et al. also teaches an electric field that is used to accelerate the particles through a nozzle (column 4, lines 10-15). As the particle speed, which is dependent on the strength of the electric field, increases through the nozzle, the stream will become defocused. This meets the limitations of claims 40 and 41.

Additionally, if one reactant and product stream is sufficient for coating a substrate, it have been obvious to have multiple reactant and product streams that coat a substrate in order to increase deposition rate, as pertinent to claim 42.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Doan teaches a laser pyrolysis method that is used to produce nanoparticles for use in polishing. Roa et al. teaches a process of producing nanostructured materials by a method of deposition.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B Fuller whose telephone number is (703) 308-6544. The examiner can normally be reached on Tuesday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703) 308-2333. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-5408 for regular communications and (703) 305-3599 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Eric Fuller
October 19, 2001

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